An operational method for vegetation mapping based on airborne imaging spectroscopy, applied to the Belgian dunes

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POSTER ABSTRACT

Vegetation maps are essential tools for planning and evaluation in nature conservation. To a large extend, management objectives can be defined in terms of vegetation attributes, either because of their intrinsic value or because of their significance in habitat characterisation. Moreover, there is an increasing demand for biodiversity indicators, for a large part due to the European Habitat Directive but also due to directives on national or regional level. The reporting frequency seems to increase simultaneously. These tendencies underline the need for efficient tools for detailed and recurrent vegetation mapping.

In the study presented the possibilities of airborne imaging spectroscopy as a tool for operational vegetation mapping was explored. The Belgian dunes were selected as study site since they are an important ecosystem with respect to nature conservation. They are the habitat of a specific and at least regionally rare wildlife and beside their biological value they serve as a natural seawall, protecting the hinterland against flooding. The integration of nature conservation and public safety requires balanced decisions and forms a major topic within the Integrated Coastal Zone Management (ICZM) in Belgium.

Firstly, historical hyperspectral data (acquired in 2000 and 2002) with different spatial and spectral resolutions were analysed to define the optimal spectral and spatial resolution for vegetation mapping. In July 2004 a new flight with an AISA-Eagle was performed recording the entire Belgian dune area. The sensor was set to 32 spectral bands with a spectral resolution ranging between 2 and 27 nm, depending on the wavelength range, and a spatial resolution of 1*1m. Extensive field work served to define the ground truth and the validation data. The images were classified using a supervised binary approach based on linear discriminant analysis. Prior to the classification, feature selection, by means of a sequential floating forward search (SFFS), was performed in order to define the optimal bandset. The output of the feature selection generates very valuable information regarding the most suited bandsettings of new multi- and superspectral cameras. They can benefit from the research conducted with

hyperspectral sensors.

As mentioned above, vegetation maps of the Belgian dunes are needed both for nature conservation and seawall protection. Therefore, two levels of classifications were made. A high ‘biological’ level with 22 classes resulting in an overall accuracy of 75%, and a low ‘seawall protection’ level with 11 classes and an overall accuracy of 80% (for the determination of the stability of the dune belt a less detailed classification is sufficient). The classification method was automated in order to be able to generate in the future vegetation maps with minimal effort. The only interaction needed is the input of georeferenced and fully corrected images, and the ground truth defined as georeferenced points or polygons. The methodology and the operational tool presented show that airborne imaging spectroscopy is highly suited to make vegetation maps with a level of detail which is difficult to achieve with other existing remote sensing techniques.